IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
Before the Board of Patent Appeals and Interferences

Applicant: Keith A. Tabor — Art Unit: 2121

Serial No. 10/810,377 — Examiner: Jennifer Norton

Filed: March 26, 2004

For: Hydraulic System With Coordinated Multiple Axis Control of a Machine Member

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APPELLANT'S AMENDED BRIEF ON APPEAL

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Appellant, Keith A. Tabor, having filed a timely Notice of Appeal in the above identified patent application, hereby submits this brief.

I. REAL PARTY IN INTEREST

The present application is assigned to HUSCO International, Inc.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF CLAIMS

This appeal is taken with respect to claims 1-28, which are set forth in Appendix A hereto.

IV. STATUS OF AMENDMENTS

An amendment was offered after the final Office Action to correct typographical errors only. Although the Advisory Action did not indicate whether this amendment was entered, it is assumed to have been entered as it did not necessitate a new search or other substantive action not previously required. The claims set forth in Appendix A reflect the correction of the typographical errors.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The present claims relate to a method for controlling movement of a member, such as a boom 13 of the telehandler 10 shown in Figure 1 of the present application. The angle of the member with respect to a reference, e.g. the tractor 12, is altered by a first actuator 16 and the length of the member 13 is altered by a second actuator 19 that telescopes two boom sections 14 and 15. (Application page 4, line 15 - page 5, line 15)

It often is desired to move the load carrier 20 at the tip of the telehandler boom in a straight line, for example to move a load horizontally through a building window. Heretofore such straight line motion required a very skilled operator who could coordinate simultaneous pivot and extension actions of the boom (Page 2, lines 12-16). The present invention is directed to a method which is implemented by a computerized controller 70 that allows the operator to designate a desired straight line motion of a point on the member and the controller determines how to drive the first and second actuators 16 and 19 to pivot and extend the boom to achieve the straight line motion.

Claim 1, and its dependents claims 2-4, involve transforming a straight line path command ($\dot{X}_{SP}$ and $\dot{Y}_{SP}$ in Fig. 4) into a desired first velocity $\dot{a}_{SP}$ for the first actuator (see Fig. 3 functions 86, 91, 122, and page 12, line 1 - page 13, line 10; page 15, line 16 - page 16, line 17). Note that in the exemplary machine, which is typical of boom machines, the first actuator 16 is a cylinder/piston arrangement that produces linear motion that angularly pivots the boom 13. Thus the velocity of the first actuator is not equal to the angular velocity of the boom. Although those velocities are related trigonometrically, the angles between the components continuously change as the boom pivots and thus the trigonometric relationship constantly changes. The straight line path command also is transformed by functions 86, 124 into a desired second velocity $\dot{b}_{SP}$ of the second actuator (supra). Then the two actuators 16 and 19 are operated based on the respective first and second velocities (Page 17, lines 15-17). By controlling the velocity of each actuator the desired straight line motion is achieved.

Claim 5, and its dependents claims 6-19, recite a method that transforms the straight line path command initially into a desired angular velocity $\dot{\alpha}_{SP}$ and a desired length velocity $\dot{L}_{SP}$ for the member, e.g. boom 13, at step 86 in Figure 4 (Page 11, lines 1-14). Then the desired angular velocity $\dot{\alpha}_{SP}$ is converted into a desired first velocity $\dot{a}_{SP}$ for the first actuator 16 that alters the angle α of the member (Page 14, line 4 - Page 15, line 9). Next, the first actuator 16 is operated based on the first velocity, and a second actuator 19 is operated based on the desired length velocity (Page 14, lines 13-17; Page 15, lines 18-20).

Claim 8, which depends from independent claim 5, provides specific equations that are used to transform the straight line path command into the into the desired angular velocity and the desired length velocity of the machine member.

Claim 10 involves transforming the straight line path command using the length (L) for the member 13 (Page 10, lines 12-21). The length of the member 13 is derived by sensing the dimension (b) of the second actuator 19, which varies that length, and then converting the sensed dimension into the length of the member (Page 8, lines 20-23).

Claim 15 states that sensing the first parameter, which in claim 12 denotes the angle α of the member 13, is accomplished by sensing a dimension (a) of the first actuator 16 (Page 12, lines 1-12).

Claim 17 specifies that sensing the second parameter of the machine, which in claim 12 relates to the length (L) of the member 13, is accomplished by sensing a dimension (b) of the second actuator 19 in Fig. 1 (Page 10, lines 12-21).

Claims 18 and 19 include sensing parameters (lengths a and b at blocks 74 and 75 in Fig. 3) of the first and second actuators 16 and 19 and deriving the actual velocity $\dot{a}$ and $\dot{b}$ of each actuator from those parameters (Page 12, lines 6-17).

Independent claim 20, and its dependents claims 21-24, call for designating first and second desired velocities ($\dot{X}_{SP}$ and $\dot{Y}_{SP}$ in Fig. 4) that the point (e.g. 22 in Fig. 1) on a machine member 13 is to travel along a two orthogonal axes X and Y. A first parameter "a", that indicates a position of the machine member, is sensed; and a second parameter "b", that indicates an amount that a first section 14 extends of the machine member from

the second section 15 also is sensed. Then, an angular position α of the machine member is derived from the first parameter "a" and the length "L" of the machine member is derived from the second parameter "b". The angular position and length are used to transform the first and second desired velocities $\dot{X}_{SP}$ and $\dot{Y}_{SP}$ into a desired angular velocity $\dot{\alpha}_{SP}$ and a desired length velocity $\dot{L}_{SP}$ for the machine member, (step 86 in Fig. 3; page 11, lines 1-14). The desired angular velocity $\dot{\alpha}_{SP}$ is converted into a desired first velocity $\dot{a}_{CSP}$ for a first actuator 16 connected to the machine member (see Fig. 3, functions 86, 91 and 122; page 12, line 1 - page 13, line 10; page 15, line 16 - page 16, line 17). The first actuator 16 is operated in response to the desired first velocity, thereby altering the angle α of the machine member; and a second actuator 19 is operated based on the desired length velocity to alter the length L of the machine member (page 17, lines 15-17).

In Claim 21, a dimension (b) of the second actuator 19 in Fig. 1 that controls the length of the boom 13 is sensed to provide the second parameter, which in claim 20 indicates an amount that a first section 14 of the boom extends from a second section 15 (Page 8, lines 20-23).

Independent claim 25 recites control system 30 that includes a input apparatus 72, 73 (see Fig. 2) that produces a command ($\dot{X}_{SP}$ and $\dot{Y}_{SP}$ in Fig. 3) designating a desired velocity of a point 22 on a machine member 13 along a desired substantially straight line path (Page 8, lines 8-11). A transformation function 86 converts that the command into an angular velocity $\dot{\alpha}_{SP}$ and a length velocity $\dot{L}_{SP}$ for the machine member (Page 12, line 1 -

Page 13, line 10). A first converter 100 translates the angular velocity into a first velocity $\dot{a}_{SP}$ at which a first actuator 16 is to move and a first driver 102 responds by operating the first actuator at the first velocity to alter the angle of the member (Page 14, lines 9-17). A control element 112, 114 operates a second actuator 19 in response to the length velocity $\dot{L}_{SP}$ to alter the length (L) of the machine member 13 (Page 15, line 22 - Page 16, line 4).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Claims 1-7, 9-13, 15-18 and 20-28 were rejected under 35 U.S.C. §102(b) as being anticipated by Brandt *et al.* (U.S. Patent No. 6,374,153).

B. Claims 8, 14 and 19 were rejected under 35 U.S.C. §103(a) as unpatentable over Brandt *et al.* in view of Igarashi *et al.* (U.S. Patent No. 4,332,517).

VII. ARGUMENT

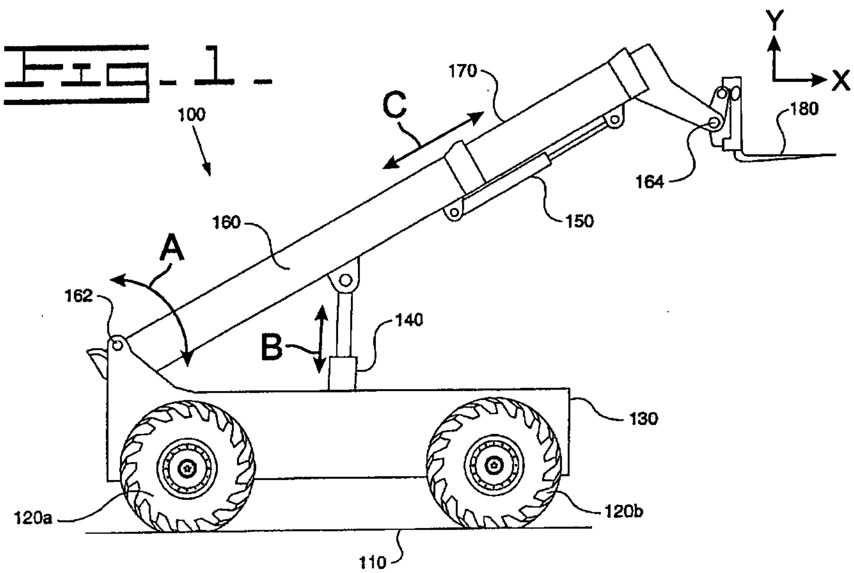
A. Claims 1-7, 9-13, 15-18 and 20-28 Are Not Anticipated By Brandt *et al.* Under 35 U.S.C. §102

Both the present system and the one disclosed in the reference control linear extension of a boom and the up and down rotation of the boom, however they control that rotation in very different manners using dissimilar control methods and systems.

The final rejection has failed to recognize a fundamental distinction between the angular velocity of the boom and the velocity of the actuator that pivots the boom. With reference to the below annotated copy of Figure 1 from the Brandt *et al.* patent, the angular velocity of the boom 160 is depicted by a curved line A, whereas the velocity of

the linear actuator 140 that pivots the boom is depicted by a straight line B. Although the boom's angular velocity and the actuator's linear velocity are related trigonometrically, that relationship varies constantly as the angle of the boom changes which affects the angle of the linear actuator 140 with respect to the boom. Thus specifying a desired value for one velocity is not equivalent to specifying a value for the other velocity.

FIG. 1



This denotes the fundamental control distinction between the Brandt *et al.* system, which controls the boom based on angular velocity, that then is converted into a fluid flow value for operating a valve, and the system in the pending claims that controls the boom by defining the velocity for the actuator, which velocity is used to control a valve. This distinction results is different steps being performed by the claimed method that are not performed, nor even suggested, by the Brandt *et al.* patent.

Claim 1 specifies producing a command which designates a desired velocity that a point on the member (e.g. the tip of the boom) is to travel along a desired substantially

straight line path, and then transforming the command into a desired first velocity of the first actuator which pivots the member. That transformation is not performed by Brandt *et al.* The passages in the prior patent cited by the rejection as allegedly describing this transformation merely describe converting the desired X-Y velocities of the fork 180 from Cartesian coordinates into polar coordinates that specify the angular velocity and the linear length velocity of the telescopic boom (col. 4, lines 5-9; Fig. 3, step 320). This produces angular velocity A and linear velocity C indicated in annotated Figure 1 above. It does not transform the command into a desired first velocity B of the first (boom) actuator.

After being adjusted by a feedback circuit shown in Figure 3 of the patent, the polar coordinate velocities are converted into <u>flow percentages</u> that apportion fluid between the first and second actuators 140 and 150 that pivot and telescope the boom (Fig. 3, step 360; column 5, lines 14-25*). The flow percentages merely determine the ratio of how much of the available hydraulic fluid flow goes to the first actuator and how much of the available flow goes to the second actuator. By keeping that ratio constant even when the amount of available flow changes which alters the actuator velocities, Brandt *et al.* maintains constant relative motion of the actuators and thus achieves the desired linear motion of the fork 180.

However, the Brandt *et al.* flow percentages do not indicate the absolute amount of flow to each actuator, as the total available flow being apportioned varies with changes in pump output, fluid consumption by other machine devices, and other factors. Since the absolute flow to each actuator varies, so too does each actuator's velocity, thus the flow

* There are many numbering discrepancies between the text and Figure 3 in Brandt *et al.* In this passage, control box 390 should be 360, control box 395 should be 370, and current map 396 should be 380.

percentage does not correspond to a desired velocity of the first actuator 140 that pivots the boom 160.

Therefore, nothing in the cited patent derives a desired velocity for the first actuator 140. As a result, claims 1-4 are not anticipated by Brandt *et al.* under 35 U.S.C. §102.

Independent claim 5 first transforms a straight line motion command into an angular velocity and a length velocity for a machine member. Then that angular velocity is converted into a desired velocity of the first actuator that pivots the member. In contrast, the Brandt *et al.* patent teaches converting a desired angular velocity and a desired length velocity directly into <u>flow percentages</u> that apportion fluid between the first and second actuators 140 and 150 that pivot and telescope the boom (Fig. 3, step 360; Column 5, lines 14-25). Because those flow percentages do not define absolute flows, which dynamically vary due to pump output changes and changing fluid demands by other actuators, the Brandt *et al.* flow percentages do not specify a desired velocity for the first actuator 140. As a result, the reference does not have the converting step in claim 5, nor does it operate the first actuator in response to the velocity value produced by that step.

Dependent claim 10 further specifies deriving the length of the member by sensing the dimension <u>of the second actuator</u> which varies that length, and then converting the sensed dimension into the length of the member. In contrast Brandt *et al.* provides a length sensor 230 that directly measures the length of the telescopic member 170 of the boom (Column 3, lines 33-36). Nowhere in the reference is a dimension of an actuator sensed for this length determination.

Claim 15 states that sensing the first parameter, which in claim 12 denotes the angle of the member, is accomplished by sensing a dimension of the first actuator. In contrast, the Brandt *et al.* system has an angle sensor 210 that directly senses the boom angle relative to the machine frame 130 (Column 3, lines 30-33). Therefore, the reference does not teach deriving the actual boom angle by sensing a dimension of first actuator 140.

Claim 17 states that sensing the second parameter of the machine in claim 12, which produces a second signal denoting the length of the member, is accomplished by sensing a dimension of the second actuator. As noted regarding claim 10, the Brandt *et al.* system has a length sensor 230 that directly measures the boom length (column 3, lines 33-37). Therefore, nothing in the reference senses a dimension of the second actuator.

Claim 18 recites sensing parameters of the first and second actuators and deriving the actual velocity of each actuator from those parameters. Nothing in the Brandt *et al.* patent relates to deriving an actual velocity of the actuator 140 that produces an angular change of the boom. Instead the boom angle is sensed and then processed at box 355 in Figure 3 to derive <u>the actual angular velocity of the boom</u>.

Therefore, claims 5-7, 9-13, and 15-18 are not anticipated under 35 U.S.C. §102.

Independent claim 20, like claim 5 discussed above, specifies "converting the desired angular velocity for the member into a desired first velocity of the first actuator", which actuator alters the angle of the member. Because the Brandt *et al.* system converts the desired angular velocity of the member directly into a fluid flow percentage, not a desired velocity for the first actuator 140, the patent does not teach the method in claim 20.

Dependent claim 21 calls for sensing a dimension (b) of the second actuator which controls the length of the boom. As noted previously, the Brandt *et al.* system has a length sensor 310 that directly senses the telescopic length or extension of the boom member 170 (column 3, lines 33-37) and does not sense a dimension of an actuator.

Therefore, claims 20-24 are not anticipated by the Brandt *et al.* patent.

Independent claim 25 recites an apparatus that has a first converter which translates the angular velocity for the member into a first velocity at which the first actuator is to move and thereby controls the angle of the machine member. As noted above, there is no corresponding converter in the Brandt *et al.* patent. Instead the patent teaches block 360 that transforms the desired angular velocity into an percentage of the available fluid flow that is to be applied to the first actuator. Nothing in that patent defines a velocity at which the first actuator 140 is to move. As noted previously, the patent's first actuator moves at a different linear velocity than the angular velocity of the boom that the actuator drives. As a consequence, claims 25-28 are not taught by the Brandt patent.

In light of the significantly distinct method and apparatus described in the Brandt *et al.* patent, claims 1-7, 9-13, 15-18 and 20-28 are not anticipated under 35 U.S.C. §102.

B. Claims 8, 14 and 19 Are Patentable Under
<u>35 U.S.C. §103 Over Brandt *et al.* in View of Igarashi *et al.*</u>

As noted previously with respect to claim 5 from which these claims depend, the Brandt *et al.* system does not convert the desired angular velocity of the member into a

desired first velocity of the first actuator that pivots the member. Nor does Igarashi *et al.* disclose this feature. As a result, claims 8, 14 and 19 are patentable for the same reasons as claim 5.

Further with respect to claim 8, the Brandt *et al.* patent describes a telehandler having a boom 160 with a telescopic member 170 that only moves linearly with respect to the boom. In contrast, Igarashi relates to an excavator that has a boom 1 and an arm 2 that only pivots with respect to the boom and does not telescope. The dissimilar components and dramatically different motion of the two machines make the equations for Igarashi excavator inapplicable to the Brandt *et al.* telehandler.

Furthermore, the specific equations contained in claim 8 are significantly different from the equations recited in the Igarashi, *et al.* patent. The presently claimed equations among other factors, include the pitch angle of the machine on which the member is mounted and the angular pitch velocity. These terms are not present in the Igarashi, *et al.* equations. Another distinction is those prior published equations use the different angles between the boom, arm, and bucket of an excavator, which angles are not found in the equations of claim 8.

Pending claim 19 is patentable for the reasons stated above regarding claim 18 from which it depends.

Therefore, claims 8, 14 and 19 are patentable under 35 U.S.C. §103.

VIII. CONCLUSION

In view of the significant distinctions between the teachings and suggestions in the patents cited in the final Office Action and the subject matter of the presently pending claims, Appellant requests reversal of the final rejection in the instant patent application.

Respectfully submitted,
Keith A. Tabor

Dated: September 12, 2007

By: George E. Haas
Registration No. 27,642

Quarles & Brady LLP
411 E. Wisconsin Avenue
Milwaukee, WI 53202-4497
(414) 277-5751

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APPENDIX A
Claims of Patent Application No. 10/810,377

1. A method for controlling movement of a member wherein an angle of the member with respect to a reference is alterable by a first actuator and a length of the member is alterable by a second actuator, the method comprises:

producing a command which designates a desired velocity that a point on the member is to travel along a desired substantially straight line path;

transforming the command into a desired first velocity of the first actuator;

transforming the command into a desired second velocity of the second actuator;

operating the first actuator in response to the desired first velocity to alter the angle of the member; and

operating the second actuator based on the desired length velocity to alter the length of the member.

2. The method as recited in claim 1 wherein producing a command comprises designating a first desired velocity that a point on the member is to travel along a first axis.

3. The method as recited in claim 1 wherein producing a command comprises:

designating a first desired velocity that a point on the member is to travel along a first axis; and

designating a second desired velocity that the point on the member is to travel along a second axis that is orthogonal to the first axis.

4. The method as recited in claim 1 wherein transforming the command into a desired first velocity of the first actuator comprises:

transforming the command into a desired angular velocity for the member; and

converting the desired angular velocity into the desired first velocity.

5. A method for controlling movement of a member wherein an angle of the member with respect to a reference is alterable by a first actuator and a length of the member is alterable by a second actuator, the method comprises:

producing a command which designates a desired velocity that a point on the member is to travel along a desired substantially straight line path;

transforming the command into a desired angular velocity and a desired length velocity for the member;

converting the desired angular velocity for the member into a desired first velocity of the first actuator;

operating the first actuator in response to the desired first velocity to alter the angle of the member; and

operating the second actuator based on the desired length velocity to alter the length of the member.

6. The method as recited in claim 5 wherein producing a command comprises designating a first desired velocity that the point on the member is to travel along a first axis.

7. The method as recited in claim 5 wherein producing a command comprises:

designating a first desired velocity that the point on the member is to travel along a first axis; and

designating a second desired velocity that the point on the member is to travel along a second axis that is orthogonal to the first axis.

8. The method as recited in claim 7 wherein transforming the command utilizes the relationships defined by the equations:

$$\dot{X} = \cos(\theta + \gamma)\,\dot{L} + (-L\sin(\theta + \gamma) + d\cos(\theta + \gamma))\,(\dot{\theta} + \dot{\gamma})$$

$$\dot{Y} = \sin(\theta + \gamma)\,\dot{L} + (L\cos(\theta + \gamma) + d\sin(\theta + \gamma))\,(\dot{\theta} + \dot{\gamma})$$

where $\dot{X}$ is velocity of the point on the member along the first axis, $\dot{Y}$ is velocity of the point on the member along the second axis, θ is the angle of the member, $\dot{\theta}$ is the angular velocity of the member, γ is a pitch angle of a machine on which the member is mounted, $\dot{\gamma}$ is an angular pitch velocity of the machine, $\dot{L}$ is a rate at which the length of the member is changing, and d is a distance that the point is offset from a longitudinal axis of the member.

9. The method as recited in claim 5 wherein transforming the command utilizes an angular position of the member which is derived by sensing a dimension of the first actuator and converting that position into the angular position of the member.

10. The method as recited in claim 5 wherein transforming the command utilizes the length of the member which is derived by sensing a dimension of the second actuator and converting that dimension into the length of the member.

11. The method as recited in claim 5 further comprising converting the desired length velocity for the member into a second velocity of the second actuator, wherein operating the second actuator is in response to the second velocity.

12. The method as recited in claim 5 further comprising:

sensing a first parameter of the machine to produce a first signal denoting the angle of the member relative to a reference;

sensing a second parameter of the machine to produce a second signal denoting the length of the member;

deriving an actual angular velocity of the member from the first signal; and

deriving an actual length velocity of the member from the second signal.

13. The method as recited in claim 12 further comprising:

generating a first error value corresponding to a difference between the actual angular velocity and the desired angular velocity;

generating a second error value corresponding to a difference between the actual length velocity and the desired length velocity;

adjusting the desired angular velocity in response to the first error value to produce a corrected desired angular velocity which is employed in operating the first actuator; and

adjusting the desired length velocity in response to the second error value to produce a corrected desired length velocity which is employed in operating the second actuator.

14. The method as recited in claim 13 wherein generating a first error value and generating a second error value both utilize a proportional-integral-derivative control function.

15. The method as recited in claim 12 wherein sensing a first parameter senses a dimension of the first actuator.

16. The method as recited in claim 12 wherein sensing a first parameter senses the angle of the member relative to a reference.

17. The method as recited in claim 12 wherein sensing a second parameter of the machine senses a dimension of the second actuator.

18. The method as recited in claim 5 further comprising:

sensing a first parameter of the first actuator;

sensing a second parameter of the second actuator;

in response to the first parameter, deriving an actual velocity of the first actuator;

in response to the second parameter, deriving an actual velocity of the second actuator;

generating a first error value corresponding to a difference between the actual velocity of the first actuator and the desired first velocity;

generating a second error value corresponding to a difference between the actual velocity of the second actuator and the desired second velocity;

adjusting the desired first velocity in response to the first error value to produce a result which is used in operating the first actuator; and

adjusting the desired second velocity in response to the second error value to produce another result which is used in operating the second actuator.

19. The method as recited in claim 18 wherein generating a first error value and generating a second error value both utilize a proportional-integral-derivative control function.

20. A method for controlling movement of a member, wherein an angle of the member with respect to a reference is alterable by a first actuator and the member has a first section that extends from a second section by an amount that is varied by a second actuator, the method comprises:

designating a first desired velocity that a point on the member is to travel along a first axis;

designating a second desired velocity that a point on the member is to travel along a second axis which is orthogonal to the first axis;

sensing a first parameter that indicates a position of the member;

deriving an angular position of the member from the first parameter;

sensing a second parameter that indicates an amount that the first section extends from the second section;

deriving a length of the member from the second parameter;

transforming the first and second desired velocities into a desired angular velocity and a desired length velocity for the member, wherein that transforming is based on the angular position and the length of the member;

converting the desired angular velocity for the member into a desired first velocity of the first actuator;

operating the first actuator in response to the desired first velocity to alter the angle of the member; and

operating the second actuator based on the desired length velocity to alter the length of the member.

21. The method as recited in claim 20 wherein sensing a second parameter comprises sensing a dimension of the second actuator.

22. The method as recited in claim 20 wherein converting the desired angular velocity comprises:

deriving an actual angular velocity of the member from the first parameter;

generating first error value corresponding to a difference between the actual angular velocity and the desired angular velocity; and

adjusting the desired angular velocity in response to the first error value to produce a corrected desired angular velocity which is employed in operating the first actuator.

23. The method as recited in claim 20 wherein operating the second actuator comprises converting the desired length velocity for the member into a desired second velocity for the second actuator.

24. The method as recited in claim 23 wherein converting the desired length velocity comprises:

deriving an actual length velocity of the member from the second parameter;

generating second error value corresponding to a difference between the actual length velocity and the desired length velocity; and

adjusting the desired length velocity in response to the second error value to produce a corrected desired length velocity which is employed in operating the second actuator.

25. A control system for a member which is movable by first and second actuators that respectively control an angle of the member relative to a reference and a length of the member, the control system comprising:

an input apparatus that produces a command designating a desired velocity of a point on the member along a desired substantially straight line path;

a transformation function coupled to the input apparatus and converting the command into an angular velocity and a length velocity for the member;

a first converter which translates the angular velocity for the member into a first velocity at which the first actuator is to move;

a first driver for operating the first actuator in response to the first velocity to alter the angle of the member; and

a control element for operating the second actuator in response to the length velocity to alter the length of the member.

26. The control system as recited in claim 25 wherein command produced by the input apparatus designates a first desired velocity along a first axis and a second desired velocity along a second axis that is substantially orthogonal to the first axis.

27. The control system as recited in claim 25 wherein the control element comprises:

a second converter which translates the length velocity for the member into a second velocity at which the second actuator is to move; and

a second driver for operating the second actuator in response to the second velocity to alter the length of the member.

28. The control system as recited in claim 25 further comprising:

a first sensor that produces a first signal indicating a first parameter which denotes the angle of the member relative to a reference;

a second sensor producing a second signal that denotes the length of the member;

a first differentiator that derives an actual angular velocity of the member from the first signal;

a second differentiator that derives an actual length velocity of the member from the second signal;

an angle controller which generates first error value corresponding to a difference between the actual angular velocity and the desired angular velocity;

a length controller which generates second error value corresponding to a difference between the actual length velocity and the desired length velocity;

a first adjusting element that alters the desired angular velocity in response to the first error value to produce a corrected desired angular velocity which is applied to the first converter; and

a second adjusting element that alters the desired length velocity in response to the second error value to produce a corrected desired length velocity which is employed by the control element in operating the second actuator.

APPENDIX B
EVIDENCE

There is no evidence, other than the documents cited in the final Office Action.

APPENDIX C
RELATED PROCEEDINGS

There are no decisions in related proceedings.